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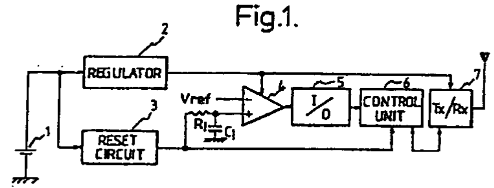
(54) Instantaneous voltage drop detector.

(57) An instantaneous voltage drop detector includes means for supplying power to a utilization circuit, first means for detecting a drop below a first predetermined level in an output voltage of the power supply means and for supplying a first detection signal having a second predetermined level different from the first predetermined level, second detecting means for judging whether or not the first detection signal continues for more than a predetermined time period, means for producing a second detection signal should the first detection signal continue beyond the predetermined time period, and control means responsive to the first and second detection signals for controlling the utilization circuit.

Fig.1.



EP 0 280 501 A1

Description

INSTANTANEOUS VOLTAGE DROP DETECTOR

BACKGROUND OF THE INVENTION

The present invention relates to an instantaneous voltage drop detector, and more particularly to a detector for detecting an instantaneous voltage drop in a battery used for a mobile radiotelephone and the like.

In a mobile radiotelephone, when a voltage drop occurs in a battery during a telephone conversation which the battery supplies power to the telephone, its transmitter/receiver section is controlled depending on the period of voltage drop. More specifically, if the battery voltage is restored to a normal level within a predetermined period of time, for example, three seconds from the voltage drop no control is conducted on the transmitter/receiver section and the telephone conversation is maintained. On the other hand, if the normal voltage level is restored later than three seconds after the voltage drop, the telephone is forced to be returned to waiting state. Unless the normal voltage level is restored even after the lapse of three seconds from the voltage drop, the mobile radiotelephone stays in an inoperable state.

In a conventional instantaneous voltage drop detector used for the mobile radiotelephone, the battery output is supplied respectively to a reset circuit and to a regulator of which output is connected to an RC time constant circuit. During a telephone conversation, the outputs from the reset circuit and the RC time constant circuit are used for logically judging whether the radiotelephone should keep the conversation or should shift to the waiting state. The RC time constant circuit provides a time, e.g., three seconds to make this judgment.

However, the conventional instantaneous voltage drop detector is inconvenient in that a detection delay occurs because the regulator output is used for the above-mentioned judgment. Moreover, when the battery output voltage is lowered only to the median voltage level, which is somewhere between the uppermost and lowermost levels, the detector often cannot detect such a drop due to the effect of the RC time constant circuit connected to the regulator output. Therefore, the conventional detector cannot correctly detect the instantaneous voltage drop.

SUMMARY OF THE INVENTION

An object of the present invention is to provide an instantaneous voltage drop detector which has no delay in the detection of instantaneous voltage drop without resorting to a specific additional circuit element.

Another object of this invention is to provide an instantaneous voltage drop detector which can detect an instantaneous voltage drop even when a voltage drop due to the failure falls only below a median voltage level.

According to the present invention, there is provided an instantaneous voltage drop detector comprising: power supply means for supplying power at least to an utilization circuit, first detecting means for detecting a drop in an output voltage of the power supply means which falls below a first predetermined level, and supplying a first detection signal having a second predetermined level different from the first predetermined level, second detecting means for judging whether or not the first detection signal continues for more than a predetermined time period and if it continues beyond the predetermined time period, producing a second detection signal, and control means responsive to the first and second detection signals for controlling the utilization circuit.

BRIEF DESCRIPTION OF THE DRAWINGS

The present invention will be described in further detail below with reference to the accompanying drawings, in which:

FIG. 1 is a block diagram showing an embodiment of an instantaneous voltage drop detector according to this invention;

FIG. 2 is a circuit showing a reset circuit in the detector shown in FIG. 1;

FIGs. 3A to 3E and 4A to 4E are time charts showing waveforms at various sections of the detector shown in FIG. 1; and

FIG. 5 is a flowchart showing the operation of a control unit of the detector shown in FIG. 1.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

In FIG. 1, an output voltage from a battery 1 (for example +13 V) is regulated to be at a predetermined level (for instance +6 V) by a regulator 2, and supplied to a comparator 4 and a transmitter/receiver (TX/RX) 7. The TX/RX 7 includes a handset unit (not shown). The output voltage from the battery 1 is also supplied to a reset circuit 3. The reset circuit 3 can detect not only a voltage drop to the lowermost level, i.e., zero volts but a drop to only a median level in the output of the battery 1, and changes its output level from high to low when it detects such drops. When the output voltage from the battery 1 has been restored to the normal level, the reset circuit 3 changes its output level from low to high. The output from the reset circuit 3 is supplied to a control unit 6 for logical judgement in order to control the TX/RX 7 after the voltage drop as well as to the comparator 4 through a CR time constant circuit comprising a capacitor C_1 and a resistor R_1. The CR time constant circuit provides a judgement time (three seconds in this instance) to determine whether or not the conversation should be maintained. The comparator 4 compares an input voltage thereto with a predetermined reference level Vref, and only when the input voltage exceeds Vref, supplies an output voltage to an input/output (I/O) port. The I/O port 5 supplies a high-level signal when it receives an input voltage, and supplies a low-level signal when it receives no input voltage, to the

control unit 6. Based on the outputs from the reset circuit 3 and the I/O port 5 during the conversation, the control unit 6 logically judges whether the TX/RX 7 is maintained at the present conversation mode or should be shifted to the waiting mode. The logical judgment will be described in more detail referring to FIG. 5 later.

FIG. 2 is a circuit showing the reset circuit 3 shown in FIG. 1. The battery output voltage supplied, through an input terminal 21, to a CR time constant circuit comprising a capacitor C_2 and a resistor R_2. The battery output voltage is also supplied to a resistor R_3 and a diode D_1 connected between a base and a collector of a switching transistor Tr_1. The detectable level in battery voltage drop can be determined by the voltage between the base and the emitter of the transistor Tr_1. The detectable level represents a median level somewhere between the uppermose and lowermost voltages of battery 1. The CR time constant circuit absorbs minute fluctuations in input voltages. The reset output is obtained from a terminal 22 via an inverter I_1 connected to the collector of the transistor Tr_1.

If a circuit which changes the voltage between the base and emitter of the transistor Tr_1 (not shown) is added, the detectable level may be changed.

FIGS. 3A to 3E and 4A to 4E are time charts showing waveforms at various sections in the detector of FIG. 1, and representatives of power failures which continue a predetermined time period (three seconds here) and less than this period, respectively.

Both in the cases where the battery output voltage drops to zero-volt (0 V) level shown in FIG. 3A within three seconds or where it drops only to the median level within three seconds shown in FIG. 3B, the output from the reset circuit 3 is changed from a high level to a low level, and then to a high level as shown in FIG. 3C. In other words, the circuit 3 produces a reset output. The output from the RC time constant circuit becomes a waveform shown in FIG. 3D due to the time constant thereof, and does not drop below the predetermined rererence level Vref. Therefore, the output from the I/O port 5 stays at a low level as shown in FIG. 3E.

When the voltage drop continues for more than three seconds as in the cases where the battery output voltage drops to the 0 V level or not to the 0 V level but to the median level as shown respectively in FIGS. 4A and 4B, the output from the reset circuit 3 is shifted from the high level to the low level, and then to the high level. In other words, it supplies a reset output. The output from the RC time constant circuit becomes a waveform shown in FIG. 4D due to the time constant thereof, and when it drops below the predetermined reference level Vref, the I/O port 5 outputs a high level pulse as shown in FIG. 4E.

In the reset circuit 3 of FIG. 2, when the input voltage supplied at the terminal 21 drops to the 0 V level as shown in FIGS. 3A and 4A, the reset output as shown in FIGS. 3C and 4C is naturally obtained from the terminal 22, and when it lowers only to the median voltage level as shown in FIGS. 3B and 4B, the reset output as shown in FIGS. 3C and 4C can be obtained from the terminal 22 so far as it is above the threshold level between the base and the emitter of the transistor Tr_1.

As mentioned in the foregoing, in the detector of the present invention, there occurs no delay in detection from the start of the drop of the battery output voltage. The present detector can also detect power drop only to a median level.

The operation of a control unit 6 during the conversation will now be described referring to the flowchart of FIG. 5. The conversation state is maintained if an instantaneous power failure is for less than three seconds, but the mode goes into the waiting state if the voltage is restored after three seconds.

In FIG. 5, unless a reset output from the reset circuit 3 is made at Step 43 during the conversation (Step 42), the process does not proceed to the next step. The absence of a reset output means either that the battery output is normal or that the power is cut off, and indicates that there is no necessity of control. When a reset output is detected at Step 43, the output from the I/O port 5 is judged whether it is at a high level or not at Step 44. If it is at the high level, it means that the voltage is restored to the normal voltage after three seconds, and thus the TX/RX 7 is controlled to go into the waiting state at Step 45. If it is not at the high level, it means that the power drop is restored within three seconds, the TX/RX 7 is controlled to maintain the current speech state at Step 46.

As described in detail above, according to the instantaneous voltage drop detector of the present invention, a regulator output is not used for detection of instantaneous voltage drop, the battery voltage drops can be detected without any delay from the start of actual drop. It further detects battery voltage drop even if it does not drop to the 0 V level but to the median level by directly connecting the reset circuit with the CR time constant circuit to thereby enable precise detection of instantaneous voltage drop.

Claims

1. An instantaneous voltage drop detector comprising:

power supply means for supplying power at least to an utilization circuit;

first detecting means for detecting a drop in an output voltage of said power supply means which falls below a first predetermined level, and supplying a first detection signal having a second predetermined level different from said first predetermined level;

second detecting means for judging whether or not said first detection signal continues for more than a predetermined time period and if it continues beyond said predetermined time period, producing a second detection signal; and

control means responsive to said first and second detection signals for controlling said utilization circuit.

2. An instantaneous voltage drop detector in Claim 1, wherein said utilization circuit comprises a transmitter/receiver.

3. An instantaneous voltage drop detector as claimed in Claim 2, wherein said power supply means is comprised of a car battery.

4. An instantaneous voltage drop detector as claimed in Claim 3, wherein said first detecting means is a reset circuit.

5. An instantaneous voltage drop detector as claimed in Claim 4, wherein said second detecting means comprises:

an RC time constant circuit having a resistor and a capacitor and receiving said first detection signal for producing a signal having a rising and a trailling edges with a time constant caused by a combination of said resistor and said capacitor; and

a comparator for comparing the output of said RC time constant circuit with a predetermined reference voltage to output said second detection signal.

6. An instantaneous voltage drop detector as claimed in Claim 5, wherein said first and second detection signals are binary signals.

7. An instantaneous voltage drop detector as claimed in Claim 6, wherein said control means comprises:

first means for judging whether or not the mode of said transmitter/receiver is a conversation state;

second means responsive to the output of said first means for detecting the presence and absence of said first detection signal;

third means responsive to the presence of said first detection signal for detecting the presence and absence of said second detection signal; and

fourth means for maintaining said transmitter/receiver in its conversation state in response to the absence of said second detection signal and for shifting said transmitter/receiver to its waiting state in response to the presence of said detection signal.

Fig.1.

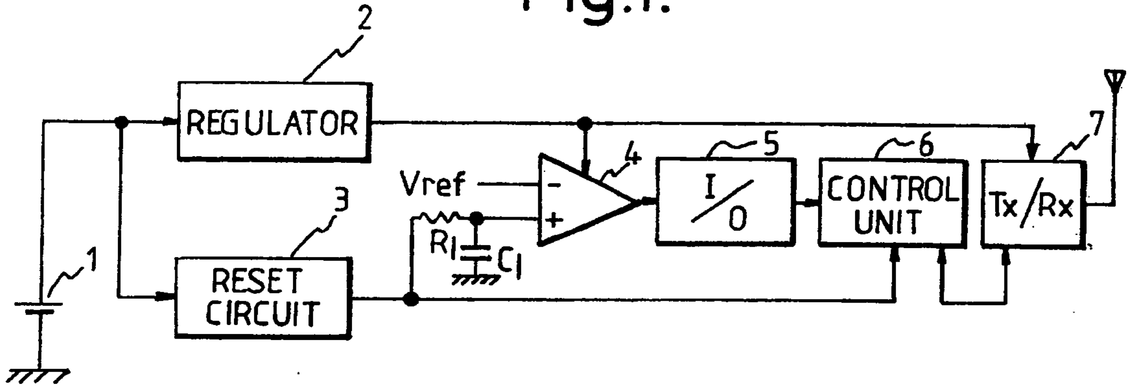
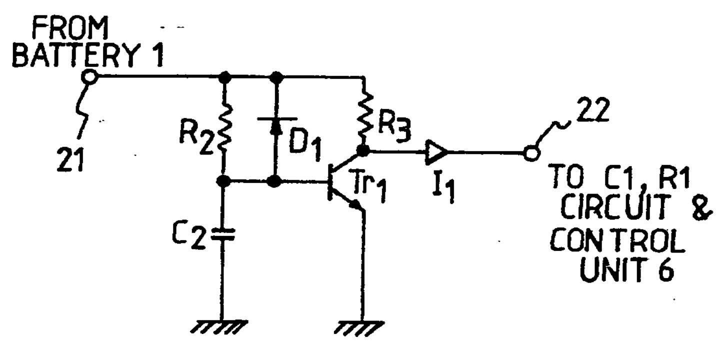


Fig.2.



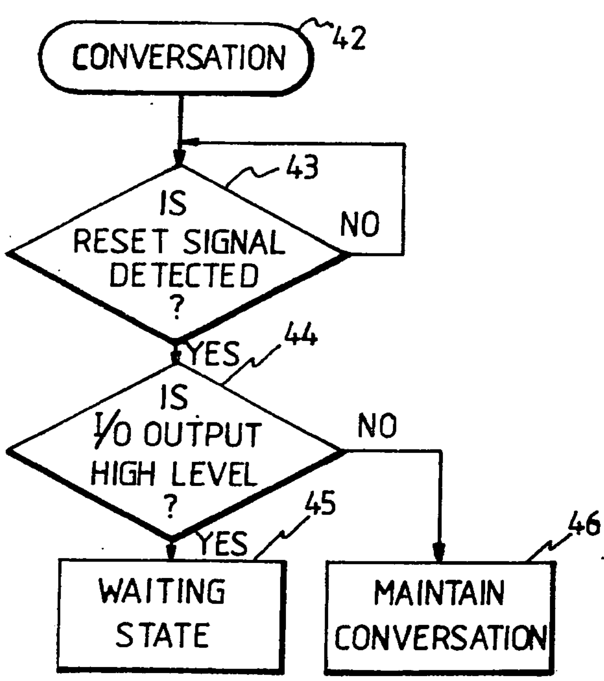


Fig.5.

Fig.3A.
(BATTERY OUT)

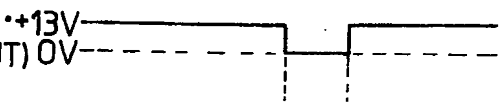


Fig.3B.
(BATTERY OUT)

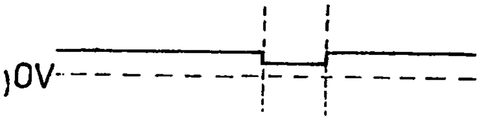


Fig.3C.
(RESET OUT)

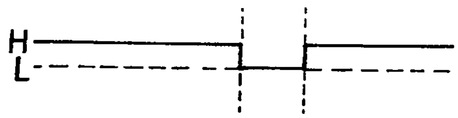


Fig.3D.
(RC OUT)

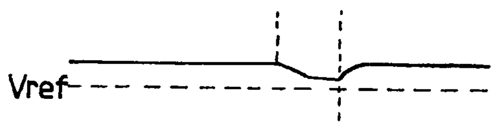


Fig.3E.
(I/O OUT)

Fig.4A.
(BATTERY OUT)

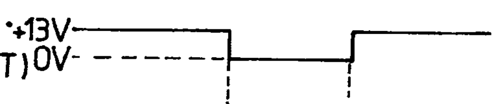


Fig.4B.
(BATTERY OUT)

Fig.4C
(RESET OUT)

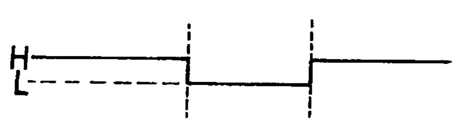
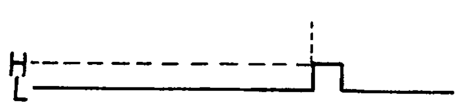


Fig.4D.
(RC OUT)

Fig.4E.
(I/O OUT)



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EUROPEAN SEARCH REPORT

Application Number

EP 88 30 1510

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.4)
X	US-A-3 670 246 (GATELY) * Figures 1,3; abstract; column 2, lines 6-10 *	1,3,4	H 02 H 3/247 H 04 B 1/44
Y		2,5,6	
Y	EP-A-0 203 781 (NEC) * Figures 2,6; abstract; page 5, line 12 - page 6, line 22; page 10, lines 14-22 *	2,5,6	
X	GB-A-1 424 550 (ADDRESSOGRAPH) * Claims 1,2 *	1	
A	ELECTRONICS, vol. 42, no. 25, 12th December 1974, pages 109,111; K.C. SEINO: "Power-failure detector is good for short lapses" * Whole document *	1	

TECHNICAL FIELDS SEARCHED (Int. Cl.4)

H 04 B
H 02 H

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	26-05-1988	KOLBE W.H.

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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